Rethinking governance and value in commodity chains through global recycling networks

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Abstract

The dominant political-economic approaches to global trade flows known as global value chains and global production networks offer powerful insights into the coordination and location of globally stretched supply chains, in particular from global South to North. By way of both conceptual and empirical challenge, this paper highlights flows of end-of-life goods from the global North towards the global South. This involves the disassembly and destruction of goods to recover secondary resources for further rounds of commodity production. Global recycling networks take things of rubbish value (often spent or 'end-of-life' goods) and turn them back into resources in other places and production networks. They operate not through adding value, but by connecting different regimes of value. The paper does not set out a new conceptual framework, but asks what challenges the rekindling of value in used goods creates for global commodity chain analysis and what insights those approaches bring to looking at 'waste' flows. The examples of used clothing and end-of-life merchant ships are mobilised to illustrate the dynamics of global recycling networks and to challenge prevailing commodity chain approaches in three key areas – supply logics and crosscutting networks, value and materiality, and inter-firm governance. We argue that resource recovery engenders highly complex and brokered forms of governance that relate to practices of valuing heterogeneous materials and which contrast markedly with the modes of co-ordination dominated by 'big capital typical of global production networks for consumer goods.

Key words: global production networks; global value chains; waste; used clothing; ship breaking; commodity chains; South Asia.

1. **Introduction**

This paper takes two influential approaches employed to analyse the globalised production of goods – global value chain (GVC) and global production network (GPN) analyses – and puts them to work to examine how spent or end-of-life goods circulate within and between states. In so doing, it challenges the often uni-directional traffic implied in prevailing political-economic approaches, not only of goods moving from poor countries to richer ones, but also from raw material to finished commodity (Lepawsky & Mather 2011).

The relocation of manufacturing industry to poorer countries and the global distanciation of supply chains have been major economic trends. More recently, obsolete and discarded products have come to constitute globalised flows travelling in the other direction. Indeed, it is salutary to observe that, in 2008, waste and scrap in general (North American Industrial Category 9100) exceeded semiconductors and electrical components to be the most valuable export category from the USA to China (US International Trade Commission DataWeb). The global exchange of spent goods for revaluation through recycling, then, is an important facet of the global economy, and one that demands further attention.

Our contention is that attending to the end-of-life of goods reveals networks as complex as those in primary production and reminds us that all such networks are not only webs of governance, but also entail material flows and transformations (Hudson 2008). Coe et al (2008, 278) point to the need to relate GPNs with material flow approaches. Bridge (2008) extends GPNs to look at resource industries, suggesting a confrontation with natural environments at ‘beginning’ and ‘end’ points, as reserves and sinks. We suggest the

'influence materiality exerts on industrial organization' that he identifies there (p415) is more pervasive than these two moments. Thus, one country's waste or discarded goods become resources recovered for further rounds of commodity production in another. To adapt Piero Sraffa's adage, commodities are made from old(er) commodities (Hudson 2008, 433). In addressing this the paper highlights how paying attention to resource recovery and global recycling can qualify prevailing GVC and GPN accounts of supply logics, the relation of value to materiality, and types of inter-firm governance.

Recent scholarship has looked at the 'mobilities of wastes' that are 'moved, with different degrees of design and legality, from place to place (and sometimes back again) and their constituent parts deconstructed, reconstructed and transformed, intentionally or otherwise, altering physical states and levels of toxicity' (Davies 2011, 1). Instead, they have traced volumes of constituent material flows (Lyons et al 2009; Terazono et al 2004) or have examined trades in hazardous materials and their reprocessing, enshrined in the 'pollution haven hypothesis,' as exemplified in patterns of trade in electronic waste (Lepawsky and McNabb 2010; Osibanjo and Nnorom 2007). Rarely do such studies look across different goods or sectors to examine contrasts and continuities in these global waste flows. These studies neither address literatures on GVCs and GPNs, nor do they utilise these conceptual frameworks (the only exceptions being Brooks 2011, Lepawsky and Billah 2011). This paper develops the dialogue between GVC/GPN concepts and literature on recycling materials.

The paper considers the globalised trades in two kinds of used goods: (i) a consumer good – used clothing or textiles; and (ii) a capital good –end-of-life merchant ships. Textiles are

taken as usefully emblematic of consumer goods. They form one of the classic sectors studied as GVCs, and one of the industries whose shifting geographies first charted an emerging new international division of labour. Ships are chosen, in part, to move away from a focus on consumer goods and post consumption wastes, but also because the merchant fleet, numbering around 26,000 vessels, is the grease that enables the vast majority of commodity chains to work. The processes enabling the physical circulation of goods have attracted remarkably little attention in economic geography (Coe et al. 2008, 276). While clearly not aiming to be representative of the entire range of the trade in discarded goods, these two cases span a spectrum of end-of-life goods. Used clothing is a post-consumer, low-value, high-volume and largely non-hazardous good that circulates widely between many destinations. Ships are a pre-consumer, high-value and low-volume good that release a myriad of hazardous wastes in their destruction. Unlike used clothing, they have limited disposal sites. The few end points for ships can be explained through the toxicity in reprocessing them (Gregson et al 2010b), the political intersection of resulting environmental issues with labour conditions in the Global South (Crang 2010), and the demand for reprocessed materials (Gregson et al 2010a). Both examples focus on the way South Asia is linked into global recycling and indicate striking commonalities there; whether other regions replicate this is a matter for further studies. Empirical material concerning clothing and textile wastes is based on ethnographic research over the last seven years following the sorting of discarded clothing from the UK through to intermediary wholesale export markets and, in turn, local traders to Indian remanufacturing industries. The material pertaining to end-of-life ships derives from three years of ethnographic research around the ship breaking industry in Bangladesh. This incorporates research in the breaking yards, business management (including cash buyers in Singapore) and representatives of associated second-hand and re-fabrication industries

Conceptually, the paper uses these two empirical vehicles to speak to, challenge and advance stabilised modes of thinking associated with GVCs and GPNs. We make three contributions to debate. First, we argue that the value chain for materials recovery is marked by different dynamics of supply and demand. Supply here is of secondary goods and is relatively inelastic, not determined by demand but by global economic conditions and markets in these and other products. Therefore, recycling often crosses and connects different sectors , products and markets. Second, to focus on resource recovery challenges accepted arguments about value – not only a process of adding value up the chain, but also a process of value extraction distributed across the globe. Extraction is linked to the material properties of end-of-life goods. Correspondingly, the paper argues for an engagement with material properties and transformations to understand the capture and realisation of value from end-of-life goods. Third, we show how intermediary agents, who are embedded in key locations and deploy relations of trust, coordinate flows in end-of-life goods. Unlike the majority of cases studied in the literature, the global flows of these goods are not dominated by large transnational corporations. Instead in resource recovery we have a form of co-ordination from the middle by brokers. Brokered forms of governance connect closely with the heterogeneous materiality associated with already used goods. This challenges notions of lead (or focal) firms associated with GVC and GPN accounts. The paper begins by examining the potential and limitations of GVC and GPN frameworks for explaining the flows of goods, value capture processes and inter-firm governance of resource recovery from end-of-life goods. It then works through those three sets of issues in turn for used clothing and merchant ships.

2. Reconceptualising global circulations through materials recycling

In framing and developing our understanding of global recycling networks, we engage with the two conceptual approaches of GVCs and GPNs. We treat them as a family of theories – with all the points of commonality and disputation that implies. The literature in this field is well furnished with critical reviews and comparisons of each framework (for examples see Gibbon et al. 2008; Bair 2005; Coe et al. 2008; Hess 2008); it is not our purpose to add to this or adjudge the relative merits of each. Our aim is not to create some new framework. Rather, we ask how the multiple economies beyond initial commodity production trouble three areas of the frameworks' assumptions, namely those around supply logics and entangled networks, value capture and materiality and inter-firm governance. These assumptions relate to an empirical tendency on the part of these frameworks to look only at certain parts of the economic life of products and to normalise patterns derived from those parts.

2.1 Making goods from older goods: logics of supply and multi-directional flows of used goods

The explanatory power of prevailing political economy approaches to globalisation is focused upon the *production* of (most commonly) consumer goods and the sequential movement of these goods from sites of production to consumption. Consumer goods receiving most attention have been electronics, tropical commodities including food and flowers, clothing, automobiles and furniture (Gibbon et al. 2008). In the context of economic globalisation, studies have most typically (though not exclusively) traced these flows from production (in the global South) to consumption (in the North). The linear assumptions underlying the GVC literature, first, are exemplified by early programmatic statements such as:

> "[The] value chain describes the full range of activities which are required to bring a product or service from conception, through the intermediary phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and *final disposal after use"* (Kaplinsky & Morris 2001, 4, emphasis added).

This *Handbook of Value Chain Research* never examines disposal and bundles recycling in with consumption as the terminus of the extended value chain. The disposal of waste is simply the end of the chain.

The GPN approach deliberately adopts the network metaphor as it offers more "multi-dimensional, multi-layered lattices of economic activity" between producers, traders, retailers, workers, states and consumers rather than a linear one-directional chain (Henderson et al. 2002, 442). Recent work has also highlighted the possibilities for addressing South-South GPNs (Murphy 2008), questioning the privileging of the western consumer as final destination of goods by pointing to demand from developing world consumers (Raghuram 2004) and flows within and between developing world markets. Nevertheless, while GPN approaches highlight the multi-directional flows of knowledge and capital, there is still a tendency to preserve a linear sense of material flows. Thus Coe et al. define:

> "The 'core' of a GPN [as] transforming 'inputs' into 'outputs' ... [i.e.] the process of *sequential* transformation from inputs, through stages of transformation to outputs and through to distribution and *final consumption*, a sequence in which each stage *adds value* to the process of production of goods or services" (2008, 274, emphasis added).

So although 'GPNs strive to go beyond such linearity to incorporate all kinds of network configuration' (Coe et al. 2008, 272), the sequence stabilised here is unidirectional and about adding value, ending with consumption. Coe et al. go on to highlight a current dearth of work in the GPN tradition on "final consumption", defined as looking at consumer spaces and the home (2008, 286). However, they stop short of addressing the economic lives of used goods either in resale or as materials for re-processing.

The assumption that basic inputs lead to more complex fabricated outputs is embedded in both GVC and GPN approaches. By way of challenge, the destruction of goods and re-fabrication of commodities from recovered materials imply more complex directions – where end of one life in one chain is always the beginning of another (Lepawsky and Mather 2011). Rekindled materials connect into new networks and, as the materials morph, so too do the forms of organisation and governance. This process creates two challenges, first to the practice of most GVC and GPN work, which tends to be based around specific products or sectors. Recovering materials frequently involves the re-composition of materials into new products and resources that cross different product and sectoral chains (Lepawsky & Billah 2011, 125). Whilst GVC literature tracks shifts in forms of coordination in terms of quality

strands for different markets (Gibbon et al. 2008, 321), variations along a chain are often bracketed out or assumed to follow from the lead company (Ponte & Gibbon 2005, 3; Sturgeon 2009, 122). GPNs offer to combine different networks vertically (finance with production) but still work with strong start and end points within each layer (Lepawsky & Billah 2011). In resource recovery, the start and end points are not so clear cut. Second, resource recovery networks challenge assumptions about supply since the impetus is generally from someone getting rid of existing, unwanted stuff. In other words, supply comes before demand. Moreover, the volume and availability of supply depends on other chains and networks. The composition of used goods is also inflexible, being determined primarily at the point of manufacture, and then overlain by patterns of use, wear and tear, and also – potentially – repair and maintenance. Crucially, the supply is therefore of heterogeneous products – what Rivoli (2005) terms 'snowflakes' each rendered individual by the effects of their usage. The derived supply of materially heterogeneous goods challenges the co-ordination mechanisms predicted in GPNs and GVCs, instead stressing the processes of determining the quality of goods moving between actors in locating value capture.

2.2 Value capture and materiality

As Gibbon et al. (2008) note, perhaps surprisingly, there has been relatively little focus upon 'value' in the literature on value chains. Within GVCs the focus has been on assessing the apportionment of accumulated value along the chain in terms of rents. In practice, this often means analysing unit prices at nodes in the chain to see if upskilling or upgrading processing might enhance value there (e.g. Ponte & Ewert 2009). But the possibilities for creating value by enhancing the product are more limited when commodities are being dismantled to their constituent materials. In practical terms, the unit price may well fall along the chain as end-

of-life goods are processed (and reprocessed), separating the constituents into recoverable resources and passing on the rest for further sorting.

While GPN approaches derive notions of value from both rent and labour theories of value, they are most concerned with locating its *capture* – in essence the control of the distribution of rents and the amount of value accruing at a specific node in the network (Henderson et al. 2002, 448-9). Much of the GPN analysis of power focuses upon this capture of value. The nature of used goods poses some problems for the categories and mechanisms GPNs usually see distributing value. First, rather than capturing some processes, in resource recovery power may be evinced more in the expulsion of certain materials; wastes may be costs to be externalised onto other actors and/or the environment. Second, Henderson et al. (2002, 448-9) suggest a series of mechanisms for capturing value, through 'brand' rents (created by product distinctiveness), 'technological' rents (due to product development), 'organisational' rents (created by superior processing within a firm), 'relational' rents (reflecting inter-firm organisation such as clustering) and, only included as a special category, 'trade-policy' rents (created by institutional barriers). We argue the importance and order of these is different for trades in used and scrap goods. Clustering and specialism in processing certainly occurs. 'Organisational' rent relates to the mechanics of processing, but is connected not so much with a 'brand' as material quality or standards of outputs. It is assessments of material quality that enable value to be realised in used goods – finding and separating the good quality components or materials. 'Trade-policy' rents is a misnomer, but in that category the often unintentional effects of environmental regulatory regimes, which are incidental in most GPN accounts, are vital. The institutional regimes controlling and classifying materials and their standards are crucial in two ways. Most obviously, they prohibit the movement of some

end-of-life goods by classifying them as wastes and mandate specific forms of processing (especially of hazardous materials). But rather more profoundly, their classifications of what is a waste and what is a resource enable value to be created when the former can be transformed into the latter. GPN approaches are sensitive to the "different institutional and regulatory *contexts* that shape international production systems" (Bair 2008, 355, emphasis added). However, attention might be deepened. The only self-styled GPN analysis of secondary goods (Brooks 2011), addresses the trade in used cars from Japan to Mozambique, demonstrating both the institutional production of a market and the legal and illicit rent extraction enabled by trade regulations.

In a different school of work, theorising through waste has long pointed out that it is less an end point than a fulcrum point. Even items discarded in dumps may be brought back into circulation and given use and exchange value once more by scavengers (Reno 2009). Studies of waste and disposal point to 'rubbish' as the transient site of plural and indeterminate values (Hawkins & Muecke 2003), rather than 'an end point in a sequence of the declining value of an object' (Hetherington 2004, 165), whilst Thompson (1979) famously argued that while most products wear out and lose value, becoming rubbish, wear and tear adds value to a few. This approach is common within work that follows the 'biographies' of things (Kopytoff 1986), and is well established in anthropological work which recognises different 'regimes of value' (Foster 2006, 291).

Drawing on this literature, it can be seen that wastes and end-of-life goods problematise the 'continuist' notion of value incrementally increasing (Foster 2006, 288), which sits at the heart of GVC and GPN frameworks. Lepawsky & Billah state:

> 'Because GVC and GPN frameworks typically conceptualize value as the proportion of final price captured by a given actor or location along a value chain or in a production network [they] fall short of being able to account for economic activity that occurs post-consumption' (2011, 123)

The difficulty in accounting for post-consumption value is because when value is rekindled in used products, it seems to appear from nothing (Gille 2010, 1054).

The ability to animate materials anew and rekindle values in used things, however, is geographically uneven and connected to the trades in used materials (Gregson et al 2010, 853). The challenge therefore is to see what approaches to the global circulation of commodities, such as GVCs and GPNs, can bring to the study of devalorisation and revalorisation and what modifications to these frameworks ensue.

2.3 Inter-firm governance: intermediary firms in intermediary places

The prime focus of the GVC approach is on the "authority and power relationships that determine how financial, material and human resources are allocated and flow within a chain" (Gereffi 1994, 97). In particular, the role played by powerful companies, so-called 'lead firms', in global economic governance is emphasised (Bair 2005, 157; Gereffi et al. 2005) and these firms are seen "as the core actors in a segmented system of global economic

governance" (Gibbon et al. 2008, 316). The focus on lead firms in GVC analysis has led to an empirical concentration on large, often transnational, corporations as producers or buyers driving commodity chains and providing "functional leadership" (Ponte & Gibbon 2005, 3). Crucially, though, this role is largely absent from global recycling networks. If, as Humphrey and Schmitz (2002, 6-7) suggest, governance is marked by five parameters of firms exercising control over what should be made, how it should be made, in what quantity, when and at what price, then none of these apply easily to used products. Instead, we point to the coordination of such chains by global trading agents, and governance from the middle rather than either producers or retailers.

The different pattern of trading throws into relief the variables suggested by Gereffi et al. (2005) in their seminal paper on GVCs to shape the governance of chains -- the complexity of transactions in the supply relationships; the ability of firms to codify the transactions; and the capabilities of the supply base –. Gereffi et al. advance a typology (constructed from these variables) of five forms of chain governance – hierarchy, captive, relational, modular and market – with the aim of bringing "some order to the variety of network forms that have been observed in the field" (2005, 79). In those terms, what characterises global recycling networks is a complex array of differently networked inter-firm relationships that correspond largely to a relational governance type. This relational governance arises, as Gibbon et al (2008, 323) explain, when:

> "product specifications cannot be easily codified, products are complex and supplier capabilities are high; this leads to frequent communication between

> buyers and suppliers within the framework of a certain degree of mutual dependence, which may be regulated through regulation, social ties and/or spatial proximity" (original emphasis).

Despite the reference in the quote above to spatial proximity, though, GVC theorists pay comparatively less attention to the complex geographies of governance modes, in favour of a focus on the organisational and economic rationalities driving these governance types. Yet, as we move on to argue, it is the spatiality and embeddedness in specific kinds of places that enables the global second hand clothing and ship-breaking networks to operate.

In terms of understanding governance, GPN studies attend to the embeddedness of supply chains in different places and "the interplay of power, value, and embeddedness dynamics at and across different spatial scales" (Coe and Hess 2005, 457). The GPN framework combines a geographic predeliction for 'territorial' embeddedness concerning the anchoring of activities in place with 'network' embeddedness referring to the "degree of connectivity within a GPN, the stability of its agents' relations and the importance of the network for the participants" (Henderson et al. 2002, 452). To this can be added "societal embeddedness" (Hess 2004, 176) relating to the non-economic, social relations in and through which firms operate. However, the places focused upon tend to be production complexes rather than intermediate places which work as pivotal nodes (Derudder and Witlox 2010). In the flows we track, the combination of different forms of embeddedness is vital, and specific sites are essential to enable those capacities and functions to work. A focus on global recycling

therefore opens up space for an advancement of notions of co-ordinating firms (by small, but influential, brokers) and the spatiality of the relational networks they drive.

Through the following analysis of second hand clothing and scrap ships we draw out three themes relating to the stabilisation and functioning of these networks. To do this, we address the three analytical threads of supply flows, the materiality of value capture and resulting spatial formations of brokered governance in the context of, first, used clothing and, second, end-of-life ships.

3. The multiple flows of the used garment sector: sorting, reusing, and reprocessing.

Secondhand textiles have a globalised geography of disposal and reuse. Textile recyclers sort clothing into reusable garments or recycling grades, the latter including industrial cleaning cloths and reclaimed fibres. The sector has globalised as a result of the growth of supply from the global North, the relocation of sorting operations to Eastern Europe and the global South, and the development of differentiated markets for reuse. The secondhand clothing economy doubled from $1.26bn in 2001 to $2.5bn in 2009.[1] Five countries (the USA, UK, Germany, South Korea and Canada) account for more than half of all exports of second hand apparel; while fifteen countries account for half of all imports (Ghana, Poland, India, Malaysia, Pakistan, Russia, Cameroon, Kenya, Benin, Tunisia, Angola, Ukraine, Canada, Germany and Cambodia – though among these are significant re-exporters). Interviews with traders show used clothing exhibits complex flows within and between multiple countries

[1] All figures are from the United Nations Commodity Trade Statistics Database for 2009, but are widely regarded as under-estimates due to the difficulty of valuing the contents of bales of used material (Hansen 2004).

3.1 Making clothes out of clothes and the multiple flows of textile waste

The supply of used clothing is not driven by demand, but rather by the relative affluence and surplus clothing of western consumers. The ever more rapid consumption of new clothing, supplied largely through globalised commodity chains, leads to ever more bulging wardrobes. As Hansen (2000, 100) suggests, 'the economic prospect of this trade [in second hand clothes] arises from the huge surplus of used garments, each of which may have many possible future lives.' The supply of used clothes is therefore controlled by the purchase of new garments mediated via the stockholding in various 'national wardrobes' and the percentage of discarded clothes that are collected. In the UK, figures in 2008 infer that, compared to the total volume of new clothing consumed annually, 23% is collected for reuse and recycling, and that proportion is rising following encouragement by policymakers, charitable appeals and an expanding textile recycling sector (Morley et al. 2009, 11). Charitable organisations receiving these donations are the largest source of garments; in the UK charities sell approximately 20% into the domestic second-hand market via their own shops and re-sell the rest onto commercial reprocessors (Hansen 2004, 3; Morley et al. 2009, 10). However, the domestic second hand market cannot absorb the flows. In the UK, estimates are that 61% are sold for re-export as garments and the remaining 15% are recycled, one half cotton clothing torn into 'wipers', and the other half winter woollens shredded for fibre reclamation (Morley et al. 2009, 12). For that latter, there is a limited UK industry for the reprocessing of reclaimed fibres into insulation and construction materials, but the majority is exported to India for reprocessing into recycled yarn and blankets.

Very little material is discarded as the garments are repeatedly resorted along the chain, with each stage retrieving usable items of lower value in a system of 'downcycling' and only the final residue being reprocessed and recycled into new products (unlike other waste sectors such as paper, plastics, ships and steel where reprocessing is central). This clearly challenges GVC and GPN assumptions of value-adding at each stage. The steady decline in the price of new clothing depresses second hand prices, a trend exacerbated by the increase in supply resulting from growing western consumption. At the same time, increasing sorting costs have led to the rise of offshore reprocessing centres based on cheap labour sources. In our fieldwork, the major one was the Indian export processing zone at Kandla in Gujarat, where one quarter of the 48 textile companies are involved in recycling, employing up to 3000 low paid workers to sort clothing and textiles for re-export to Africa. The trade also exemplifies the struggle over trade policy rents but ones which show multi-directional entanglements across chains. These have sometimes appeared 'non-economic' -- masquerading as hygiene rules – but are based on contestable claims that this in effect is dumping cheap (used) garments that might harm the market for domestic (new) garment producers (Hansen 2004). Counter-arguments claim that the trade creates jobs in apparently different sectors -- amongst the networks of traders, tailors and launderers across recipient countries (Baden & Barber 2005). India, with its long and politicised history of defending domestic weaving, for example, has historically restricted the import of wearable used clothes. Hence, the network had to be embedded in an export processing zone; an in-between space outside Indian import restrictions. It was a notable shift when an exemption was granted to 14 companies there, permitting them to sell 15% of the second-hand clothes into the Indian market. However, clothing rendered un-wearable through mutilation prior to importing has always been permitted as a raw material to be re-spun, due to a lack of supply in the Indian wool market

(Norris 2005). Second hand clothing, which has been depicted as problematic in terms of being a cheap import, can become useful if it is turned into raw material.

3.2 Extracting value from second-hand clothes

Remarkably, used clothing overwhelmingly originates as a gift by western donors. Value appears from something that is not only at the end of one life, but given away for nothing. The process is a recommodification of something that once was purchased, then had personal values and then became a gift, illustrating Kopytoff's (1986) argument that objects move in and out of the commodity phase. To extract that value requires increasingly fine grained sorting. Although clothing may typify high-volume, low-value goods, the materials themselves are not homogeneous. Every item is individual, in terms of both the variety of products and their condition. The realisation of value therefore depends upon the process of capitalising upon this material heterogeneity. The lack of standardisation within any bale means sorting is like 'panning for gold'.[2] Some discarded items, if they are separated and sent to a different market, may move from Thompson's (1978) rubbish value to durable category, if they stop being 'old' and become 'retro' or 'vintage', where age and patina adds value. Those rare items form the most profitable part of the process. For most items, though, value is extracted through re-sorting and re-amalgamating bundles for different markets (Hawley 2006).

[2] 'Panning for gold' seems to more accurately convey the sifting of materials than Hawley's (2006) 'digging for diamonds'.

Western charities tend not to be in the business of shipping and sorting clothes on a global scale. Instead, there are multiple layers of agents, brokers, importers, wholesalers, retailers and remanufacturers, located in different countries, involved in the sorting and re-sorting of the garments to fit consumers at different destinations. Given the fixed nature of the supply, dealers have to work hard to develop increasingly differentiated markets for the flow of goods available, many travelling extensively to research export markets first hand. This is not just a matter of fashions, and matching the climatic needs between global North and global South. Differentiated valuing also responds to body sizes and patterns of wear. This latter point explains why a recent trend, observed in our fieldwork, has been for the produce of large sorting operations in South Korea and Malaysia to command the highest prices in Delhi, as the clothing sizes match the Indian recipients. U.S. and European clothes tend to fit African consumers better, and are resold there although cross-cultural strictures on female dress rule out many garment styles. Clothing suitable for reuse in Africa is sold for around £1,100 per tonne (Morley et al. 2009,55), but often fetches considerably less if sold to the Indian domestic market because the typical body shapes of western consumers need to be aligned with possible future wearers. This may require reprocessing to add or realise value – with respondents reporting the re-fashioning of many US women's nylon trousers into male labourers' trousers by cutting off the elasticated waistband, adding drawstrings and 'Adidas style' white stripes down the sides.

An indication of the complexity of market differentiation and the work that is encoded within shipments of goods is evidenced by the number of sorting categories used by initial recyclers. Varying between 150 and 400 categories, this information is closely guarded as it is the basis for profitable revaluing (Botticello, forthcoming). The market is broken down into major

segments: Eastern Europe (top quality all-season, nearly new, consumer brands), Africa (good quality summer wear), and Pakistan (lowest quality). Each market segment has its own system of classification, and the manipulation and maintenance of these by particular intermediaries is the key to those sorting companies creating an element of what the GVC literature would call 'modularity', where the brand name of the textile recycler tells importers the expected quality of clothing types being shipped, but it does not indicate the specific garments in each bale.

An analysis of used clothing discloses a multilayered process of sequentially stripping out value, whereby consumers discard what they do not want, charity organisations discard what they do not think they can resell themselves, domestic recyclers then sift that for 'vintage' or 'retro' clothes and sell the remainders to international traders, who in turn re-sort it for different destination countries. Then, in those countries, wholesalers and dealers will sort the shipment again, breaking it into smaller bundles to fit their own market niches (Rivoli 2005, 193; Hansen 2000; Norris 2005). Intermediaries are vital to reach the final small-scale, often family run, enterprises from small reselling stalls in Africa to fabric processors in India. These small-scale enterprises have neither the knowledge, nor the capital, to interact with western sorting companies. At each step, the unit prices fall, but it is finding the 'right' nugget or individual item from a bale of clothes, the one which fits a market niche for a trader at that stage, that may well create the profit from a whole bale. Detailed knowledge of the potential customers forming the next link in the chain favours a large number of small-scale, attentive actors. As Rivoli argues:

> "[T]he snowflake factor means that the most successful firms in the industry are those with highly developed expertise in picking out special snowflakes, and with worldwide but personal relationships that allow them to match snowflakes with customers. It is hard to see how a big multinational could pull it off. Here, finally, is a global industry for the little guy" (2005, 178).

Material heterogeneity thus pushes towards a relational governance structure here. Those garments where no market can be found for them as reusable items are sold to be reprocessed to recover their material constituents – by this stage fetching the lowest unit price (£50-£100 per tonne) for this last residual value. This is a business concentrated in South Asia, centred in the town of Panipat in Haryana. Importing up to 350 containers per month (8,750 tonnes), local informants suggested that local mills produce about 4-500 tonnes of recycled yarn per day. Upon arrival clothing is again sorted, removing buttons and fittings for resale, alongside brand labels that can be affixed to remanufactured clothes. Then machines, themselves bought second hand from long defunct and unprofitable western reprocessors, macerate the clothing and reduce it to its constituent fibres. With the addition of oils and other binding agents, the fibres are then re-spun to make 'shoddy' yarn.[3] Interviewees estimated that 30-40% of that output is woven into men's shawls, floor coverings or fabric for garments and the remaining 60-70% is woven into blankets. This recycling network, in contrast to most GVCs and GPNs in the current literature, therefore extracts value by

[3] Shoddy is the term for rewoven wool fibres. The fibre lengths are shorter than new wool leading to an inferior quality; and hence the wider connotation of the work. In the nineteenth century this reprocessing was commonly used in the English textile belts to make cheap clothes for the working class, with residues and scraps. Even the 'devil's dust' might also be bound in, as Marx put it (1867, 133).

working through the material variations in products in a series of stages with the unit price falling.

3.3 Brokerage, reprocessing and the relational governance of used clothing

The process of value capture, involved in 'panning for gold' makes small-scale, as opposed to 'big capital', intermediaries central to the flow of second hand garments. The multiple directions and flows of textiles and used clothing highlight not only an important role for intermediary actors and places, but also, in GVC terms, relational modes of doing business. While some elements of used clothing chains exhibit levels of integration such as tied deals between very large western charitable collectors and commercial rag dealers, the movement of goods beyond the developed world is a complexly brokered affair.

This brokered form of governance is linked in two ways to the high degree of material heterogeneity discussed above (Section 3.2). First, knowledge of multiple distant markets is crucial in extracting value from any given bale of clothing. In unbundling and sorting it, the issue is to meet the demand from clients in different markets for different kinds of clothing and fabrics. Here, different strands in a network operate with differentiated parts of the supply. Second, there is an enormous possibility for opportunism here, in Gereffi et al's (2005) terms, to ship substandard goods or indeed to realise profits by undervaluing supplies. Since purchasers can never predict what is in a bundle of used clothes until it is opened, the need for trust in and knowledge about the reliability of sorters give rise to a relational form of governance.

Against Gereffi et al's (2005) predictions, complex inputs here lead to simpler outputs and although the industry is labour intensive, with low asset specificity and ease of entry, it requires high level competences among dealers to source those materials. Therefore the used clothing "business is highly dependent on global contacts that take years of nurturing in order to have markets to sell their sorted goods" (Hawley 2006, 265). In GPN terms, such connections involve mobilising both network and societal embeddedness. Increasingly, brokers are developing capabilities to evaluate the possible value in bales and maximise yields in different markets. Thus, key agents in the African purchasing markets have taken to sending younger relatives working as apprentices to sorting plants in Europe, precisely to train the sorters in specific market knowledge to maximise profitability (Abimbola forthcoming). The brokers' capacities to organise the trade also depend on developing network embeddedness. Key traders and figures foster long-term relationships to build trust in the quality of supply – be that through kinship networks, ethnically organised networks or social ties exemplified by cases of UK textile recyclers talking of attending the weddings of children of key Indian intermediaries. So in this sense, the GPN framework's attention to the interplay of network and societal embeddedness is helpful in understanding inter-firm governance in the context of used clothing, but GPN studies rarely link this to the material properties and heterogeneity of goods.

4. Scrap ships: material recovery and refabrication

The geography of ship breaking has undergone a series of shifts often characterised as a race to the bottom of labour costs and environmental controls. Broadly, ship breaking in Europe and America became globally insignificant by the early 1980s and by the late 1990s, India, Bangladesh and Pakistan accounted for around 80% of all ship breaking globally. In 2009,

more than 1000 ships were demolished with 38% of the tonnage handled at Chittagong (Bangladesh), 36% at Alang (India) and 10% at Gaddani (Pakistan).[4] The shift to low cost South Asian breaking yards was enabled by using open beaching. The ships are steamed at full speed onto the beaches. There thousands of low paid workers using little more than hand held blowtorches and diesel powered winches rip the ships apart in a matter of a few months. The resultant environmental contamination and dangerous working conditions arguably represent a cost expelled rather than a value captured.

4.1 The entangled supply networks of ship breaking

The flow of end-of-life ships does not fit GVC templates. Since ships are broken by cheap labour, the expectation would be a chain driven by large-scale, buying corporations operating as lead firms. However, buyers do not control the supply of ships for scrap. Ships may be sold several times in their lives, but the last sale is for scrap value – to recover the values of their constituent materials. As they move from the second-hand 'sale and purchase' market to the 'demolition' market, the metric of their value is transformed from dead weight tonnes (dwt), or the amount they can carry, to light weight tonnes (ldt), that is, the weight of metal that composes their hulls. In this change of metric, we see them cross value regimes. In their life, the 'dwt' of a ship is intimately tied to cargo capacities and charter freight rates. As they are scrapped, the 'ldt' of a ship highlights the value of materials that may be recovered.

[4] Figures derive from EA Gibson shipbrokers. The other large player is China, which demolished 15% of tonnage that year. Different years and measures can vary the proportions, but the pattern remains similar with four major breaking nations. The United Nations Commodity Trade Statistics Database shows a similar pattern over the last decade, but there have been no official figures for Bangladesh since 2007.

Ships leave networks of global production and enter the scrap market at around 25 to 35 years old. The supply of ships for recycling is therefore fixed in terms of pre-given characteristics, while the quantity follows the global business cycle, but in a counter-cyclical fashion. As such, when there are downturns in global trade, reducing the freight and charter demand, shipping firms scrap greater numbers of ships. Breaking volumes therefore tend to rise during global recessions. Study of end-of-life ships reveals and challenges tacit assumptions common to both GVC and GPN frameworks of the linear transformation of simpler materials into complex products. Here, a complex product (that itself enables many other chains) is broken into simpler constituent parts to be refashioned for use in other value chains.

4.2 Realising value from disassembling ships

Bangladeshi ship breakers have created a highly coordinated system to realise value from the materials of the ship and the possibilities to reprocess it. The agglomeration of breaking yards and reprocessing industries near Chittagong acts to create relational rents, in GPN's terms (Henderson et al. 2002, 450). Such clustering enables 99% of each ship to be recycled (Gregson et al 2012). Well over 90% of the weight of the scrapped ships is comprised of the steel of the hull, the remaining amount being fixtures and fittings. These two waste streams become materials in further commodity cycles.

The steel from these vessels represents, in a figure often cited by our interviewees in the industry, 80% of total domestic supply and is 30% cheaper than the price of imported steel; in GPN terms a value captured in the Bangladeshi economy. The vast majority of this steel is used as reinforcing rods in concrete buildings. As with textiles, the extraction of value is

strongly influenced by the nature of the different materials realised, and their different values and processing attributes. As heterogeneous products each ship can be more or less easily disassembled. Complex internal structures, of which there are more in liners, ferries and car carriers, tend to produce less easily used pieces and also mean that those vessels take longer to demolish, with a consequent delay in realising value as greater interest on the money borrowed to purchase the ship accrues. Such vessels therefore tend to attract a lower price in the global demolition market.

Ancillary fittings on ships have also become a source of value. A market in secondary goods has emerged as a co-product of breaking involving both dynamics of value enhancement and the intersection of new domestic and international commodity chains. That this is a supply-driven network is reflected in interviews with those involved in reprocessing furnishings, illustrated by comments that in the early 90s such material was simply dumped and breakers would ask "who will take this rubbish off my hands?" There was neither a buyer for the material, nor value in it. Since then, the production and elaboration of a new market has found value in that rubbish, exemplified by more than 70 furniture re-processors and sellers, as well as electrical and engineering refurbishing works, which have emerged North of Chittagong around the Dhaka highway (Gregson et al 2010).

Some of the latter materials are reprocessed as capital goods (Gregson et al 2012). Thus, at the top end of the market, electrical and motor components are stripped, refitted and resold globally as spare parts for ships, meeting demand for both cheaper parts and also obsolescent ones no longer being produced by manufacturers. However, the network spreads wider than

the shipping industry, since electrical motors, and the cabling they need, right down to boards used as work surfaces, offer a cheaper source of capital goods to most small garment manufacturers in Bangladesh. Boilers and tanks find a ready home in the fabric dyeing process. From the steel in the fabric of the buildings, to the generators powering machines, to the cabling transporting the power, to the very boards on which sewing machines stand, the global ship recycling network is bound into the rather more prominently studied global export chains and networks of the garment sector. The materials cycle back into other production networks. This is more than simply the leakage and linkage of commodity chains, such as furnishings and fashion, operating in parallel (Leslie & Reimer 2003). Rather, in this case the material flows and values captured (from cheap supplies) link the chain of pre-consumer wastes in multiply entangled production networks.

4.3 The embeddedness of relational ship breaking networks

The ship breaking industry in Chittagong shows elements of vertical integration and forms of captive governance, in GVC terms. Some of the money to purchase ships for smaller yards may be loaned by steel mills in exchange for favourable tied supplies. And some of the largest ship breakers have acquired re-rolling mills. However, the globalised network of end-of-life ships is neither vertically integrated, nor driven by the presence of large transnational firms. Rather, it is highly brokered like the governance of waste textiles. Although some shipping companies are large transnational firms, none are involved in the business of scrapping itself.[5] Indeed, the process of distancing through layers of agents (Clapp 2002)

[5] By dint of acquiring another firm, the shipping giant Maersk inherited a ship recycling division, which brokered contracts with a Chinese breaker. However, it recently closed that unit and the personnel have formed an independent company.

between themselves and the controversial breaking beaches helps to protect them from reputational risks. This creates a global network of relatively small-scale players operating forms of brokerage. Typically a shipping line hires a broker to solicit bids from a range of 'cash buyers', who sell the ships on to breaking yards. Neither ship-owners nor breakers directly participate in the market and all the work, from valuing ships to the organisation of transactions, is conducted by small-scale intermediaries. Given that each ship entering the waste chain is unique, the only 'product' specifications are fairly generic registration documents. There is no standardised price or modularisation of supply relations. The brokers and cash buyers in the network move between shipping centres like Singapore, Hong Kong, London, Alexandria and, increasingly, Dubai. At this node in the chain there is a market mode of governance (in GVC terms), but as we show below it relies on relational networks between intermediaries with high levels of capability (possessed neither by ship owners, nor by breakers).

Cash buyers' capabilities need to extend from knowledge of globalised shipping to the rather more localised requirements of breakers concerning the specific material properties of the ships. As outlined above, breakers have preferences based on the structures of the ships and the estimated proportions of different metals in them. Cash-buyers value ships for sale in terms of those properties. Quality issues are therefore tightly connected to the material properties of the ship and the breaking process, through expert knowledge rather than being encoded in standards (cf. Ponte & Gibbon 2005). The ship breaking network exhibits the conditions of high product specificity and coordination costs that tend to push for a 'relational' buying network, in GVC terms (Gereffi et al. 2005, 81).

The cash buyer is the intermediary who has the capabilities to link breaking yards, generally run by small-scale entrepreneurs, to a global market. As one cash buyer put it, the yard owners – as with used-clothing sellers – "lack the capacity to efficiently deal with international business". In contrast, as with the international traders in used-clothing, cash buyers have the capability to operate in the global market. They have the necessary linguistic and technical competences, alongside a high degree of knowledge of shipping trends. These are relatively infrequent transactions for discrete and heterogeneous items, where buyer capability is low, but is mediated by capable intermediaries in whom both sellers and buyers can repose trust. Thus in a shift from the governance permutations outlined by Gereffi et al (2005, 87) in this chain, intermediary capability is the crucial issue – not producer capability. In the global ship recycling network, it is *intermediaries* who supply technical and institutional competences.

The form of trust invoked here might seem to be a deterritorialised "trust-based network embeddedness" (Bair 2008, 356). However, in practice this network embeddedness also requires territorial embeddedness (Hess 2004). For example, a leading cash buyer for Bangladesh has a headquarters in an office block populated by various marine producer services in Singapore, a known centre for maritime knowledge economies (Sassen 2010, 156). One of the senior employees commented that everything depends on reputation, something that took years to build. Location in the city enables the cash buyer to access the financial institutions capable of the codified standards, which in turn are vital for the large payments for vessels. Here the "nature and articulation of firm-centred production networks" are not merely "deeply influenced by the concrete socio-political contexts within which they

are embedded" (Henderson et al. 2002, 446), but are *actively enabled* through those material and socio-political resources.

With regard to inter-firm governance and its spatiality, the cash buyers therefore form the bridge or articulation between different value regimes and 'normative orders' in the language of conventions theory (Ponte & Gibbon 2005). Their embeddedness in global shipping networks is enabled by territorial embeddedness in Singapore. However, it is simultaneously their ability to connect that with societal and network embeddedness involving breakers that enables them to manage the vicissitudes of financial exchanges with Bangladesh. Here it is personal contacts and associations that provide the degree of trust in managing large future-based transactions, with the Bangladeshi financial regulations only allowing payment through letters of credit that would not be readily accepted by global shipping companies.

5. Conclusion

This paper has taken used clothing and end-of-life ships in order to question some key assumptions about supply flows, value and governance, which are found in both GVC and GPN approaches to the analysis of global trade. It highlights that the lack of attention in these approaches to the after-lives of goods which, when they are acknowledged, tend to be positioned as end-of-pipe concerns (as waste and simple disposal) and are bracketed with consumption, which itself is a neglected facet of value chain research. The analysis of end-of-life goods challenges the singular direction assumed in dominant political-economic value chain approaches, as old goods are reused, or refabricated and, in so doing, intersect multiply

with other value chains. While the network metaphor invokes multiple connections, the assumption of a single value regime remains.

Most notably, focusing on old commodities becoming other commodities suggests that the logic of governance and value is different within global recycling networks, where products entering networks do so not at the behest or to the specification of the buyers, and the sellers have little interest in their 'disposal' or future use. 'Big capital', lead firm-driven modes of governance are not apparent in the South Asian centred networks studied here. Instead these cases point to a key role for a brokered form of coordination. Intermediaries bridge the societal embeddedness of local actors and the expertise needed for network embeddedness in global transactions. Further, our research reveals the key role of two different spatialities in producing and stabilising global recycling in ways that extend the sense of spatiality in GPNs. First, the role of intermediary places in acting as a conduit for transactions is apparent. Their infrastructural and institutional capacities enable actors to embed themselves in global networks and sustain the relational coordination of the network. Second, the regulatory regimes of different locations and their articulations are vital to making new commodities from old. Ships and clothing reveal the differential patterns here because of their different materials. The paths of discarded clothes are shaped by the different taxes, values and demands depending on whether they are processed as clothes for re-use or fibres for reweaving in India. Since ships contain hazardous materials, it is the laxer environmental regulation in Bangladesh (and India and Pakistan) that enables their transformation from uneconomic vessels into secondary resources. In contrast to the 'continuist' theories of value in GPNs and GVCs, it is crossing value regimes that creates the opportunity to capture value by creating markets in recovered materials, which offer cheap supplies and thus cheap

products that would not otherwise exist. These flows across value regimes connect and entwine different sectors and networks in ways that confound assumptions of linear processes.

While our research has applied existing GVC and GPN notions of value, this analysis of global recycling networks also proposes advancement of these concepts, with particular significance for understanding governance. These recycling networks demonstrate the central importance of materiality to the governance of value capture and extraction. Both ships and clothes are heterogeneous, unique products entering the supply chain. The buyer has no control over their fabrication, specification or prior use. Even mass produced goods become unique due to the differential wear and use affecting its condition. Finding value in recycling is therefore about the arts of making do with what is there. Both used textiles and end-of-life ships show the processes of exploiting and working with the heterogeneous material properties of goods to extract values. The material qualities of products and the transformations possible from them in different places are crucial at every stage, whereas GPNs and GVCs have tended to see them as external outcomes of, or constraints on, production (Bridge 2008) if at all. Therefore, and against the backdrop of GVC and GPN tendencies to explain governance patterns in terms of firm-centred transactions costs and spatialised labour theories of value respectively, we argue recycling networks highlight the effects of the materiality of goods and the cultural practices of valuing this materiality in explanatory accounts of governance.

The multiple connections and directions of disposal networks re-stage many issues addressed in literatures on value chains and production networks. To that extent these flows are amenable to, even demand, these forms of analysis. The complex geographies of flows in both the case studies here link western consumption to small scale reprocessing firms in South Asia. It remains a matter for further study as to whether these global recycling networks will be stabilised or transformed over time, whether they are replicated in other places, notably China; and whether or how global recycling flows are in turn affected by attempts to enhance recycling activities within western economies. The patterns our analyses disclose are the kinds that GVC and GPN approaches are intended to interrogate. However, the turning of old commodities into new commodities has hitherto not been the focus of work in these areas. Attending to them means challenging assumptions about value adding activities, lead firm-driven processes and reveals the role of materials, places and flows more starkly.

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